REMARKS:

1) The Examiner's attention is directed to two new Information Disclosure Statements filed on January 9, 2007 and January 18, 2007. Please consider the references, and return initialed, signed and dated acknowledgment copies of the two IDS Forms PTO-1449 of January 9, 2007 and January 18, 2007.

2) A few minor clerical corrections have been made in the specification, without introducing any new matter.

The points raised by the Examiner in the specification objection at pages 2 and 3 of the Office Action have been taken into account.

The title of the invention has been amended to be more specific and descriptive of the claimed invention. The Examiner's suggested title has been considered but not directly adopted, for example because the barrier layer is not necessarily limited to ZnMgBeSe, but is necessarily an i-type barrier layer.

Reference to "Fig. 3" has been inserted at page 11 line 9, according to the Examiner's suggestion.

The correction of "sell" to --cell-- at page 12 line 12 was already carried out in the amendment of November 7, 2005.

At page 13 line 26, "contact layer 8" has been corrected to --contact layer 7-- as pointed out by the Examiner.

The text at page 16 lines 8 to 11 has been corrected and clarified for consistency with the subject matter shown in Fig. 8, as pointed out by the Examiner.

At page 17 line 11, "ZnCdSe/ZnSe" has already been corrected to --ZnCd/ZnSe-- in the amendment of November 7, 2005.

In view of the present and previous corrections, the Examiner is respectfully requested to withdraw the objection to the specification.

3) The previously pending claims have been maintained without further amendment, and new claims 26 and 27 have been added. Claim 26 expressly emphasizes a feature supported by original claim 1, and by the drawing figures and example embodiments presented in the specification. Claim 27 is supported by a combination of claims 6 and 12. Thus, the new claims do not introduce any new matter. Entry and consideration thereof are respectfully requested.

4) After the present amendment, claims 1, 3 to 6, 11 to 13, 26 and 27 are directed to and read on the elected species of Fig. 10. Claims 2, 7, 14 and 15 remain withdrawn. In the event that a generic claim is ultimately found allowable, the Examiner is respectfully requested to rejoin, consider and allow the dependent withdrawn claims 2, 7, 14 and 15.

5) Referring to pages 3 to 6 of the Office Action, the rejection of claims 1 to 3 to 6, 11 and 13 as obvious over US Patent 5,299,217 (Migita et al.) in view of US Patent 6,870,178 (Asryan et al.) and US Patent 5,747,827 (Duggan et al.) is respectfully traversed.

Present independent claim 1 recites four important features which, in combination, support patentability of the claim.

a) Claim 1 is directed to a semiconductor light emitting device of a group II-VI compound semiconductor.

b) A barrier layer is arranged between and in contact with an active layer and a p-type cladding layer.

c) The barrier layer is a non-doped i-type material.

d) The barrier layer consists of a single monolayer and is not a multi-layer structure.

It is especially important to have a non-doped i-type barrier layer between and in contact with the active layer and p-type cladding layer. This prevents problems that otherwise arise if a p-type impurity doped layer is in contact with an active layer. If a barrier layer is doped with p-type impurities, the impurities cause a high concentration of point defects in the barrier layer. If such a p-type doped layer is in contact with an active layer, it will reduce the light emission efficiency for the following reasons. First, electrons injected into the active layer will leak into the p-type doped layer, and the electrons will be captured in a defect level of the layer due to tunneling. Secondly, the impurities cause point defects and will be diffused from the barrier layer into the active layer and will thereby decrease the crystallinity of the active layer. Such problems are avoided by providing a non-doped i-type barrier layer in contact with and between the active layer and the p-type cladding layer according to the invention. Thereby, the light emission efficiency can be increased. Such benefits would not have been suggested by the prior art. More

importantly, the structure of the inventive device as defined in present claim 1 is not disclosed and would not have been suggested by the prior art.

It is significant that the Office Action of May 25, 2005 in this application made a species Election Requirement among Fig. 1, Fig. 7, Fig. 10, Fig. 14 and Fig. 17, due to patentable distinctions between the respective structures disclosed in those Figures. That species Election Requirement makes clear that different arrangements of layers have patentably significant distinctions. For example, the elected species of Fig. 10 has a barrier layer between a p-type cladding layer and an active layer. The patentably distinct non-elected species of Fig. 14 does **not** have a barrier layer between the p-type cladding layer and the active layer, but instead has the active layer sandwiched directly between and in contact with two cladding layers (see Fig. 14). The species Election Requirement expressly asserts that there is a patentable distinction between Fig. 10 and Fig. 14, which involves the distinction between having and not having a barrier layer between the p-type cladding layer and the active layer. Another distinction between Figs. 10 and 14 is that the other cladding layer is either n-type or undoped, but that distinction does not involve the interaction between the active layer and the p-type cladding layer.

In view of the species Election Requirement of record, it must be recognized that there is a patentable distinction between having or not having a barrier layer interposed between the p-type cladding layer and the active layer. In the present

elected invention of Fig. 10, there is a barrier layer interposed between the p-type cladding layer and the active layer.

In the Examiner's primary reference of Migita et al., there is no barrier layer between the p-type cladding layer and the active layer as acknowledged by the Examiner. Thus, in this regard the Migita et al. reference is like the non-elected species of present Fig. 14 (no barrier layer) and unlike the elected species of present Fig. 10 (with barrier layer). In fact, to the contrary of the present elected invention, Migita et al. expressly disclose and rely on a structure in which the active layer is sandwiched directly between and in contact with a p-type cladding layer and an n-type cladding layer (see col. 1 line 60 to col. 2 line 9, col. 2 lines 29 to 57, col. 4, lines 51 to 58, etc.).

This distinction (as acknowledged by the Examiner) between the present invention and Migita et al. is a patentably significant distinction according to the species Election Requirement of May 25, 2005, i.e. is a non-obvious distinction which cannot be overcome by the citation of additional references. Otherwise the species of Fig. 10 and the species of Fig. 14 would not have been distinct species.

For a suggestion regarding the barrier layer, the Examiner has turned to Asryan et al. However, the barrier layer disclosed by Asryan et al. is **NOT** formed of a group II-VI semiconductor material according to the present invention, but instead is formed of AlInAs, which is a group III-V based material. Still further, the arrangement of the barrier layer according to Asryan et al. is significantly different from that of present claim 1,

because the Asryan et al. barrier layer (116) is **NOT** arranged between and directly in contact with both an active layer and a p-type cladding layer. Instead, the barrier layer (116) is arranged between and in contact with a quantum dot active region or layer (110, 112, 114) and a quantum well layer (118), with a further optical confinement layer (120) interposed between the barrier layer and the p-type cladding layer. Thus, the barrier layer is not directly in contact with the p-type cladding layer. As such, not only is the structural arrangement different, but the function and operation of the layers is significantly different from that of the present invention.

Asryan et al. rely on the barrier layer providing a function of allowing tunneling of majority charge carriers (holes when the barrier layer is located on the p-side). Thus, the preferred film thickness of the barrier layer is only 10 to 20 Å (1 to 2 nm) (see col. 13 lines 1 to 19, col. 14 line 58 to col. 15 line 14). In contrast, the barrier layer according to the present invention (and especially the barrier layer made of ZnMgBeSe as defined in claim 6) is less likely to block charge carrier holes, and thus there is no need to transport the holes to the active layer through the barrier layer by a tunneling effect. It is therefore possible to provide a significantly thicker barrier layer (e.g. at least 5 nm according to present claim 12) in the present invention.

Note that a new claim 27 combines the subject matter of claims 6 and 12, to particularly emphasize this express distinction between the present invention and Asryan et al. Namely, claim 27 requires both a thickness of the barrier layer

to be at least 5 nm, and the material of the barrier layer to be ZnMgBeSe. This combination emphasizes that the barrier layer of ZnMgBeSe does not have a tendency to block charge carrier holes and can thus be thick, which simplifies the fabrication process. This feature is directly contrary to the references.

Even a combined consideration of Asryan et al. and Migita et al. would not have suggested the present inventive combination of features of claim 1. Migita et al. has no barrier layer between the p-type cladding layer and the active layer, and Asryan et al. have a group III-V semiconductor barrier layer and a further quantum well layer and a further optical confinement layer between the p-type cladding layer and the active layer. Thus, even a combination of the references would not have suggested a group II-VI semiconductor barrier layer between and directly in contact with the p-type cladding layer and the active layer, because neither reference discloses or suggests such features.

The Examiner tacitly acknowledges that Asryan et al. do not disclose the group II-VI semiconductor material for a barrier layer directly in contact with the active layer and the p-cladding layer, and cites Duggan et al. in this regard. Particularly, the Examiner has referred to Duggan et al. for disclosing a barrier layer (58) between and respectively directly in contact with an active layer (62) and a p-type cladding layer (64). However, the barrier layer (58) of Duggan et al. is **NOT** a barrier layer consisting of a single monolayer of i-type semiconductor material, but instead is a superlattice structure comprising stacked alternating layers of MgS and layers of SnSe

(col. 11 line 11). The superlattice structure has carefully controlled film thicknesses of the alternating MgS and SnSe layers in order to exhibit a barrier effect against electron transport, and necessarily to transport holes from the p-type cladding layer to the active layer through the barrier structure by a tunneling effect. That is in contrast to the present invention (as discussed above) in which the barrier layer is less likely to block charge carrier holes, so that there is no need to utilize a tunneling effect. Thus, according to the invention, the barrier layer can be embodied as a single monolayer, without rigid control of film thicknesses, so that the fabrication process is simplified.

In view of the above, even a combination of all three references would not have suggested the present invention. Migita et al. have no barrier layer. In Asryan et al., the barrier layer is not located and arranged as presently claimed. In Duggan et al. the barrier layer is not a single monolayer, but rather a multilayer superlattice structure which has a significantly different function and effect as compared to the single monolayer barrier layer according to the present invention. A person of ordinary skill in the art would have been faced with a "mixed salad" of disparate teachings of the references with no guidance or suggestion to select particular ones of those teachings or separate out distinct features, so as to instead achieve the ordered combination of these features according to present claim 1. It appears that the Examiner is improperly using hindsight knowledge of the present invention gained from the present application to provide guidance, in the

manner of a blueprint, for "picking and choosing" different features out of the different references and then assembling those features in the manner as presently claimed. That is not a proper basis of an obviousness rejection.

The references would not have provided any suggestions toward the modifications and combinations necessary to achieve the present invention. For example, if a barrier layer would be embodied as a single layer in a device according to Duggan et al. in view of the Asryan et al. reference, a possible example of a single layer material might be MgS or SnSe. However, such an MgS layer would have significant lattice mismatching and a crystal structure mismatch, so that the MgS layer would not have been suitable as a barrier layer. On the other hand, if the SnSe layer was selected as a single barrier layer, the band gap of the SnSe layer would be smaller than that of a cladding layer, and thus it would not function as a barrier layer. Thus, even if a single monolayer barrier was formed using layer materials according to Asryan et al. in the structure of Duggan, a barrier layer according to the present invention could not have been achieved, and the structural arrangement, position, and functional effect thereof would have been significantly different. There are no suggestions of the prior art to overcome these differences.

There are also no suggestions of the prior art to overcome the patentable distinction between the different structural arrangements or inclusion verses non-inclusion of a barrier layer, according to the species Election Requirement set forth in the Office Action of May 5, 2005.

The dependent claims are further patentable already due to their dependence from claim 1.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1, 3 to 6, 11 and 13 as obvious over Migita et al. in view of Asryan et al. and Duggan et al.

6) Referring to page 6 of the Office Action, the rejection of claim 12 as obvious over Migita et al. in view of Asryan et al. and Duggan et al., and further in view of US Patent 6,555,403 (Domen et al.) is respectfully traversed. Claim 12 depends from claim 1, which has been discussed above in comparison to Migita et al., Asryan et al. and Duggan et al. Furthermore, according to present claim 12, the barrier layer has a thickness of at least 5 nm. That is a significant distinction from Asryan et al. and Duggan et al., as discussed above. Establishing obviousness is not merely a matter of finding another reference that happens to have a barrier layer with a thickness of at least 5nm. The significant differences of Domen et al. cannot be ignored. Domen et al. provide a multi-layer region including several graded layers to form a barrier layer region. The semiconductor material is a group III-V semiconductor. The arrangement of the barrier region is also not directly between an active layer and a p-type cladding layer as presently claimed. Thus, the layer thickness cannot simply be plucked out of the context of the reference. A person of ordinary skill in the art knows that different layer thicknesses are pertinent in different structural arrangements, functional operations, and contexts. For these

reasons, the Examiner is respectfully requested to withdraw the rejection of claim 12 as obvious.

7) Favorable reconsideration and allowance of the application, including all present claims 1 to 7, 11 to 15, 26 and 27, are respectfully requested.

Respectfully submitted,
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Enclosures:
Transmittal Cover Sheet
Term Extension Request
Form PTO-2038

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